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ANTIBIOTIC RESISTANCE
CONFRONTING THE GLOBAL CRISIS

PLUS: Brexit; Flooding in France; Nanoparticles & First Responders; Agriculture & terrorism; Search & Rescue in Antarctica; Crisis leadership; Stability policing; Public information & social media; Conflict de-escalation; Robotic developments; Command & Control in the 21st Century

CRISIS RESPONSE

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As usual, this edition spans emergency and disaster analysis, prevention, protection, preparedness, response and resilience.

Admittedly, it is equally morbidly fascinating and disturbing to see how crises intersect, conflating and exacerbating one another, spawning greater emergencies that appear simply beyond the scope of prevention or mitigation, sometimes leaving agencies seemingly powerless to respond effectively to their sheer scale and complexity. But how bad is the global situation?

After all, it is not beyond experts' capabilities to predict, identify and categorise tomorrow's most devastating disasters. Terrorism, natural catastrophes, conflict: This edition addresses and provides insight into all of the above.

At this time, we don't have definitive statistics for 2016. But, despite the widely-held perception that terrorist attacks are increasing, the US State Department's annual terrorism report notes a 13 per cent decrease in attacks in 2015, with 14 per cent fewer deaths. This year's figures might be higher (page 52), and modus operandi may be shifting, but the line between criminality and terrorism has become blurred, and we must be wary of classifying all violent criminal acts as terrorism, as Christine Jessup warns (page 54).

Again, we know that natural disasters are on the rise. But Munich Re says last year saw a fall in losses from such catastrophes in terms of incidents, fatalities and in financial losses.

Granted, these figures are in no way cause for complacency; we are certain to face larger and more complex emergencies in the future. But there is an even greater lurking disaster, which *CRJ* has touched upon in past editions (Prof Steiner, *CRJ* 10:1); one that we can no longer afford to ignore. Deaths in a world without antibiotics could dwarf all other catastrophes, killing up to ten million people a year (page 26).

How sobering it is to reflect that, despite all our technological advances, prevention, co-operation and hard work in crises and disasters, an absence of antibiotics would not only claim more lives than climate, conflict and terrorism combined, but augment their effects immeasurably. Let's hope that the high level UN meeting on this subject in September produces the unequivocal commitment that this smouldering global health emergency demands.

Emily Hough

Agriculture as a terrorist target

Agriculture and environmental systems are fundamental to human existence, but are often overlooked in the security context and are vulnerable to attack. **Christoph Schroth** identifies the risks, their mitigation and way forward

Environmental and agricultural systems are the foundation of human existence on earth, as without the right environmental conditions the effectiveness of agricultural endeavours would be minimal, thus putting global health and political stability into jeopardy. The majority of literature addresses the terrorist threat, its mitigation, preparedness and response, but does not specifically address a significant sector of the US and global populations' foundation, that of agriculture. This article will examine the level of preparedness and most likely target of such an attack, as well as make recommendations to enhance preparedness and mitigation.

The agricultural sector is made up of many direct and indirect components, such as plants, livestock, personnel, manufacturing and processing plants and is a large part of the national infrastructure. The US has approximately 2.1 million farms and 200,000 registered food manufacturing, processing and storage facilities, while the UK has approximately 214,000 farms. National budgets on terrorism mitigation, preparedness and response have grown rapidly over the last decade and have created a: "Well protected public infrastructure" but "agriculture is one that has received very little attention in this regard," according to Chalk (2001).

Not all aspects of agriculture are as vulnerable as others but, says Chalk, livestock is an ideal target for a variety of reasons. Increased use of steroids to maximise meat production has led to increased stress levels and decreased resistance to infections, making livestock more susceptible. Vaccinations are not compulsory for many conditions, despite the growing concerns over the vulnerability of the agricultural sector. Chalk lists 22 conditions that this applies to and this list does not include potential agents that could be used by a potential attacker. Vaccinations can never address all potential threats, but as is the case in the human population, currently non-prevalent conditions should not be considered to be 'extinct' because there is a lack of recorded outbreaks.

Owing to the large nature of processing and food production facilities (eg dairy farms and their milking facilities), an outbreak at one facility could spread extremely quickly and would justify the mass slaughter of all animals within it, in order to minimise further spread of the disease/infection. According to one model by the US Department of Agriculture, Foot and Mouth disease: "Could spread to as many as 25 states in as little as five days through regulated movement," alone.

The production and processing industries, according to Chalk would also not be particularly helpful in limiting the spread of contaminated products, as their security, product recall procedures and staff screening criteria are also inadequate.

Biological warfare is no modern invention, but owing to national and international trade and travel, the potential for global consequences are greater than ever before. As early as the 14th century BC, rams were used as a carrier of tularaemia to target enemies during a conflict, but documented cases are more commonly found from 1155 onwards when Barbarossa poisoned wells with human bodies in Italy.

Evidence of attacks against any agricultural system is particularly hard to find, as any outbreak of diseases or infestation in animals or plants is particularly difficult to link to specific events or malicious acts. In the United Kingdom, Public Health England (PHE) is currently investigating an outbreak of Escherichia coli O157 (E. coli, also known as VTEC), with 109 cases reported until July 4, 2016 and no confirmation of the source of the outbreak. Several individuals are believed to have eaten mixed salad containing rocket leaves, but this does not account for all cases. E. coli O157 can lead to kidney failure, stomach pain and bloody diarrhoea and is transmitted via contaminated food, such as vegetables or undercooked meat, touching an infected animal or their faeces and contact with infected individuals. All of these transmission routes are likely to be part of daily activities on farms, making identification of the origin of the organism very complicated to trace, if not impossible. No particular producer, farm or facility has been identified and, from publicly available information, this does not appear to be a malicious act or attack.

However, this case is a reminder of how even accidental exposure to a pathogen, where most steps of the process the product undergoes are known, can be challenging to trace. An intentional release or introduction of an organism into the product – with avoidance of detection being part of the attackers' strategy – would be even more difficult to identify.

The basis of any successful attack is the means and availability of the required knowledge, personnel, equipment and motivation to execute the planned attack. As discussed above, the agricultural sector has not been well prepared for a terrorist threat, reducing the amount of knowledge and resources required to initiate an attack, as there are less prevention measures in place.

Means to execute an attack can occur at multiple levels, depending on the would-be perpetrators' abilities. The simplest approach would start at the level of the farmer, who either ▶

▶ personally or unknowingly through staff, introduces a disease into the livestock or fresh produce before it is sent to the processing facilities, either on or off site. This is what could have occurred in this year's case of E. coli O157 in the UK and might not even have been caused by a person, but by a faulty piece of equipment. The lack of monitoring and screening procedures at these facilities could lead to a rapid spread and possibly undetected distribution, not just nationally but internationally. Olson (2012) supports this theory, arguing that fruit and vegetable packaging facilities are: "Among the most vulnerable venues for food-borne attacks." Either way, both livestock and fresh produce face similar challenges as diseases, pathogens and chemicals could be introduced and unknowingly distributed to various locations without any knowledge or intent of the facility or its staff.

Mitigation has to start with an appropriate risk assessment of the entire industry to identify all potential origins of significant threats. These threats might only be the ones identified by Chalk, but could already have been modified or changed to meet the goals of the terrorist groups that are planning on using them since his paper was published in 2001. In the meantime, basic measures, such as increased regulations for employee screening, quality control and surveillance of facilities could help to eliminate the risk from 'entry level' criminals who are attempting to trial attacks in a small scale experiment before targeting a larger facility/target demographic.

Screening of all individual items that depart or enter farms, processing and packing facilities is unlikely to be a viable option, as tests are time consuming, require a budget to accommodate this and these are statistically not likely to be a source of a potential attack at this time.

Updating of emergency response plans is also a key intervention and while the National Incident Management System (NIMS) can be used for any type of event, without further allocation of resources and mitigation plans the incident commander will not have any means to effectively execute his/her duties in such a scenario. Chalk also recommended the adjustment of the veterinary science curriculum to include: "A greater emphasis on large-scale animal husbandry and foreign/exotic disease recognition," essentially increasing the chances of abnormal conditions to be recognised earlier. Should this threat be ignored, the likelihood exists that an attack could be undetected, leading to the death of a significant amount of people worldwide.

Chalk points out that, as a consequence, the US economy could become unstable through lost revenue and possible international trade restrictions, which would most likely result in loss of political support by the general population (ie the voters) and go as far as social instability owing to a resulting mass panic from these attacks.

First line of detection

Preparedness and mitigation planning not only need to include actions to take following an outbreak, but also measures to address public concerns and responses to actual or suspected attacks.

Incident identification and response are another important area. In the event of an attack, response procedures need to be initiated and effectively executed, which raises the question of levels of preparedness and knowledge in emergency responders, physicians, law enforcement personnel and people involved in agricultural and related activities regarding acts of bioterrorism. A study of 34 undergraduate medical schools in the UK and Ireland found that "little teaching" on bioterrorism, chemical weapons and biological weapons currently takes place and suggests that the situation would only change if the schools were required to address this. Before victims of any attacks present to healthcare facilities or law enforcement officials are alerted, farm personnel are the first line of detection and defence against bioterrorism and they should be included in training and response planning endeavours. But what knowledge do they need to possess?

The Criminal Investigation Handbook on Agroterrorism, published by the US Department of Agriculture, provides many clues on what to watch out for, but there are no definitive signs that point towards an attack. Pattern recognition in livestock population, fresh produce, staff behaviour and other anomalies is the most likely way to identify a potential threat/attack or disease. Law enforcement, like many other branches of public safety, is also affected by budget cuts, but is responsible for leading the investigation into all criminal incidents, including (bio) terrorism, until the appropriate lead agency takes over; a task for which it is not necessarily prepared or funded to prepare for. In order for local law enforcement agencies to be able to notify their superiors of suspected acts of bioterrorism, they would need to be able to identify them, which is always a challenging task, even with specialist training.

First responders, law enforcement officers, ambulance personnel and other frontline healthcare providers should be made aware of potential signs, symptoms and clues that might point towards a biological agent or pathogen having been deployed. That said, an attack could be or will most likely be: "Virtually indistinguishable from natural outbreaks," at least for a certain amount of time, and: "A naturally occurring epidemic could provide the attacker with deniability," according to the USDA. This is because its signs and symptoms cannot necessarily be attributed to a particular pathogen.

Environmental targets are another area where attention is required. There is no doubt that the attack on an ecosystem, such as a dam, wetland or a source of drinking water, would have detrimental consequences but in order to harm the highest amount of people, the method of targeting livestock and fresh produce appears to be the more likely of the two. Contamination of drinking water, for example, would probably only affect one or two regions, owing to the way in which water is distributed. Vulnerable points in a water distribution system are also more easily controlled than farmland, as these are dedicated facilities within a reasonably small area. Targeting a farming community would spread the disease through the entire county and country within days, possibly even globally, before a potential attack would be detected. By comparison, a contaminated water source could be tested, isolated and decontaminated, which would limit the amount of individuals exposed to the biological agent. This is not the case with contaminated animal products and fresh produce, as individual components might be spread out over various counties, facilities and areas, significantly hindering accountability regarding its origin and controllability of the pathogen.

The lack of risk assessments in the agricultural and environmental systems sectors has undoubtedly allowed their vulnerability to terrorist attacks and care has to be taken not to focus only on prevention and preparedness, but also detection and response. First responders, farm staff and all other personnel involved in food production and agriculture should be encouraged to raise anything they consider suspicious, without risk of repercussion for expressing their concerns. Terrorists, like other criminals, will always aim for the weak points in a system. A successful attack could result in consequences far beyond traditional terrorist acts and could bring the threat into every home in the US (or elsewhere in the world).

Public fears could become so immense that political instability is a strong possibility, ultimately playing into the hands of terrorists. Fear plays a key role in terrorism and large numbers of casualties are not necessarily needed to achieve this. People being afraid to undertake everyday activities – such as eating or drinking – could have much further reaching consequences than a physical, violent attack on particular targets. CRJ

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